Dividing by cx and equating to zero, $\log\frac{1}{x}=\frac{1}{2}$.

Whence, $\frac{1}{x}=\sqrt{e}$, and $x=\frac{1}{\sqrt{e}}$.

MECHANICS.

104. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pa.

From a locomotive and tender standing still on a bridge, the pressure on the bridged is $p_1=80$ tons. The track is supposed to be straight and practically horizontal. Had the locomotive and tender been running at the rate of $r=60$ miles an hour, how many tons would the pressure on the bridge have been?

II. Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics. The Temple College, Philadelphia, Pa.

Regarding the earth as a perfect sphere and neglecting its rotation, we get for latitude, θ.

Centrifugal force$=\frac{Wv^2}{gR\cos\theta}=f$,

where $W=80$ tons$=160000$ pounds, $v=60$ miles an hour$=88$ feet per second, $g=$gravity$=32.16$ feet, $R=$radius of earth$=3956$ miles$=20887680$ feet.

$\therefore f=\frac{1239040000}{671747788.8\cos\theta}=\frac{1.8445}{\cos\theta}$ pounds.

If the locomotive is running on a great circle, $f=1.8445$ pounds.

$P=$pressure$=W-f=159998.1555$ pounds.

$\therefore P=79.99908$ tons, or practically 80 tons, the original weight.

105. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

Let $2a$, $2b$ be the diagonals of a rhombus, φ the angle the principal axis at the mid-point of a side makes with the diagonals. Prove $\tan2\varphi+\frac{3}{5}\tan\beta$, when β is an angle of the rhombus. The principal moments of inertia about this mid-point of the side are $\frac{1}{24}m\{5a^2+5b^2\pm\sqrt{[25(a^2+b^2)^2-64a^2b^2]}\}$.

Solution by the PROPOSER.

Let $ABCD$ be the rhombus, side c. EF, FB the axes; $\angle DAB=\angle EFB=\beta$; $\angle\theta=$the angle the principal axis makes with the side AB at its mid-point F; $\angle\varphi$, the angle the principal axis makes with the diagonal.

Then $\Sigma mxy=\rho\sin^2\beta\int_{-\frac{1}{2}c}^{\frac{1}{2}c}\int_0^c(x+y\cos\beta)ydxdy=\frac{1}{3}\rho c^2\sin\beta\cos\beta=\frac{1}{3}mc^2\sin\beta\cos\beta$.

$\Sigma mx^2=\rho\sin\beta\int_{-\frac{1}{2}c}^{\frac{1}{2}c}\int_0^c(x+y\cos\beta)^2dxdy=\frac{1}{12}m(c^2+4c^2\cos^2\beta)$.